The Integration of Retail Space Markets

Executive Summary. *This study estimates optimized portfolios on an efficient frontier of real estate investment in the retail sector of fifty-eight metropolitan markets (MSAs), using quarterly sample data covering 1987–2000. The efficient opportunity sets and associated percentage allocations are determined for the entire sample of fifty-eight MSAs, as well as for subsets for each region of the country. Findings indicate that some regions offer much higher performance in a risk / return occupancy context than others. Also, the occupancy risk / return performance improves substantially when allocations are not limited to particular regions, suggesting that the retail space markets are relatively segmented.*

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Introduction

An important issue facing many real estate investors is whether to seek reductions in risk through geographic diversification. If space markets are integrated, then the price of risk is the same in all markets. In this case, diversification across markets achieves no reduction in risk. If metropolitan areas have their own real estate cycles and if the cycles are relatively uncorrelated with each other, then the benefits of diversification will be large. Alternatively, if markets are highly integrated, the payoff to diversification will be minimal.

The benefits of real estate diversification have been widely studied over the past two decades. Seiler, Webb and Myer (1999) review much of this research in a recent literature survey. Most of the diversification research has utilized return series derived from indexes developed by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NCREIF data track quarterly appraisal-based returns by sector for a limited number of metropolitan statistical areas (MSAs), and the return series apply only to real estate held in private equity portfolios. For real estate investment trust (REIT) portfolios, there is no geographic return series that managers can use when applying standardized asset allocation methodologies. REIT managers could, of course, employ the NCREIF data, but given the low correlation of the NCREIF series with REIT returns, this approach may be questionable.

This study explores a different approach. Occupancy data obtained from F. W. Dodge is used to

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estimate optimized portfolios on an efficient frontier of real estate investment in the retail sector in fifty-eight metropolitan markets. Using this approach permits an evaluation of mean-variance efficiency for portfolios covering a larger number of MSAs than is available with the NCREIF series. By focusing on the retail sector, the benefits of geographic diversification can be concentrated on, abstract of sector diversification issues.

The article is divided into four sections. The next section provides a review of the relevant literature. Next, a discussion of the methodology and data used in the analysis is followed by the empirical results. Finally, the last section summarizes relevant findings and discusses possible extensions of the research.

Literature Review

A number of studies have explored the variation in real estate portfolio returns and how variation in returns is related to geographic location. Articles in this area include Hartzell, Schulman and Wurtzebach (1987), Hartzell, Heckman and Miles (1986), Corgel and Gay (1987), Malizia and Simons (1991) and Mueller (1993), among others. Goetzmann and Wachter (1995) apply a cluster analysis to vacancy rate data from twenty-two metropolitan statistical areas (MSAs). They find that the MSAs tend to cluster into a smaller number of "family" groups and that these groupings are related to the dominant industries in each cluster. The implication of their research is that real estate diversification can be obtained by diversifying among city clusters, rather than across cities, but the city clusters are not necessarily geographically contiguous.

Hanink (1996) examines the impact of regional versus national market conditions on local vacancy rates in the retail sector. His research indicates that the local vacancy rate is primarily influenced by the vacancy rates in surrounding MSAs, that is, he finds evidence of strong spatial autocorrelation among the cities in his sample. The implication is that diversification can be achieved by diversifying across geographic regions that are regionally contiguous.

Benjamin, Jud and Winkler (2000) also study the variations in market vacancy rates in the retail space market. They report results similar to Hanink (1996) for vacancy rate levels, but they find further that *changes* in vacancy rates evidence little correlation across time or space. They report that changes in the national vacancy rate are associated with widely different changes in metropolitan vacancy rates, so that proper diversification may require more than simply spreading investments among a few large geographic regions.

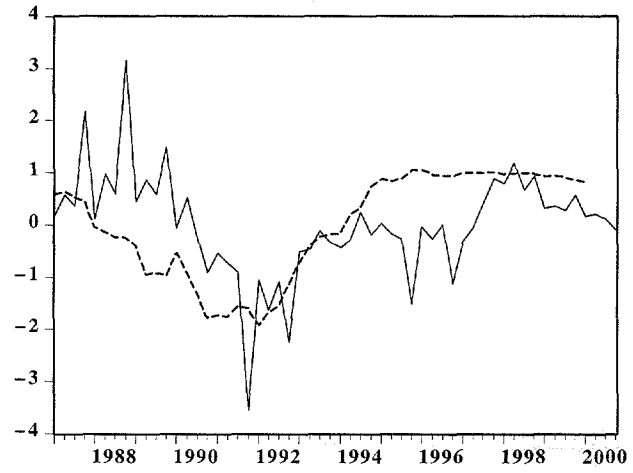
Methodology and Data

This study reexamines the benefits of market diversification across retail real estate markets. Assessment of the benefits of diversification requires the measurement of market returns and risks. Most of the diversification research has utilized return series derived from indexes developed by NCREIF. Unfortunately, the NCREIF data track quarterly appraisal-based returns by sector for a limited number of metropolitan statistical areas (MSAs), and the return series apply only to real estate held in private equity portfolios. For REIT portfolios, there is no geographic return series that managers can use when applying standardized asset allocation methodologies.

Lacking a comprehensive return series for retail real estate investment, this study uses occupancy rates obtained from F.W. Dodge. While occupancy rates are not a complete measure of real estate returns, they are significantly correlated. The correlation coefficient for the two series is 0.39, which is statistically significant at the .005 level. Exhibit 1 shows the relationship between the NCREIF retail real estate return series and the F. W. Dodge retail occupancy series from 1987:1 through 2000:1. From Exhibit 1, it is clear that the series cycle move together very closely.

The F. W. Dodge series is used to estimate optimized portfolios on an efficient frontier of real estate investment in the retail sector in fifty-eight metropolitan markets. Using this approach permits an evaluation of mean-variance efficiency for portfolios covering a larger number of MSAs than

Exhibit 1
NCREIF Returns and Occupancy Rates (normalized scale)



—— NCREIF Retail Returns ---- F. W. Dodge Occupancy Series

is available with the NCREIF series. By focusing on the retail sector, the benefits of geographic diversification can be concentrated on, abstract of sector diversification issues.

Modern portfolio theory developed by Markowitz (1952) and the use of optimization techniques permit the determination of efficient opportunity sets with occupancy risk/return profiles and accompanying allocations. If retail real estate markets are effectively integrated, then market diversification will not provide significant reductions in risk. The purpose of this research is to investigate the extent of integration of the retail space markets and determine the allocations among MSAs necessary to achieve efficient opportunity sets.

While the Markowitz model was originally designed for use in a stock portfolio context, the model has extensive possibilities for use in other contexts when covariance has a noticeable impact on the volatility of a portfolio of assets or markets. Recent research has applied the Markowitz model in such divergent areas as life-time consumption patterns, international investing, mutual fund investing, and holdings of foreign currencies.[1]

Suppose that the expected occupancy rate for MSA_i is defined as $E(O_i)$, and w_i is the percentage weight attributable to the occupancy rate of the MSA. Then the expected occupancy rate for a portfolio of N metropolitan areas is defined as the weighted average of the individual expected occupancy rates in the N metropolitan areas as follows:

$$E(O_p) = \sum_{i=1}^{N} w_i E(O_i). \quad (1)$$

The portfolio variance is the weighed sum of variance and covariance of occupancy rate terms for all combinations of occupancy rates in metropolitan areas i and j as follows:

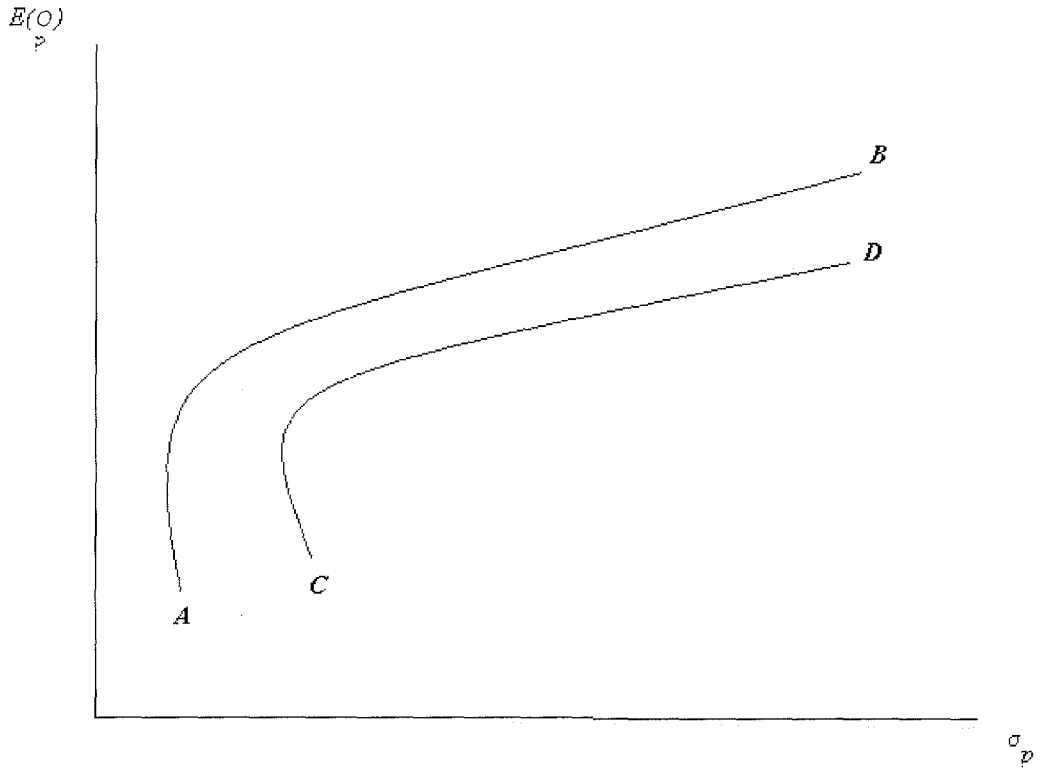
$$VAR\ (O_p) = \sum_{i=1}^{N} \sum_{j=1}^{N} w_i w_j \sigma_{ij}. \quad (2)$$

Where σ_{ij} is the variance term when $i = j$ and the covariance term when $i \neq j$; w_i and w_j are the percentages allocated to each metropolitan area i and j.

The efficient set is the mean-variance choices of metropolitan areas from the opportunity set of all MSAs, where for a given variance (or standard deviation), no other selection of opportunities offers a higher mean return. This is shown in Exhibit 2 as *AB*. The opportunity set *CD* is not an optimal set because *AB* offers a higher portfolio occupancy rate for a given risk (defined as the standard deviation of the portfolio occupancy rate). The line *CD* could be a constrained set of metropolitan areas, or a misallocation of weights among the metropolitan areas.

This study seeks to identify the metropolitan areas that are part of the efficient set, and what allocations or weights are necessary for each MSA to become part of the efficient set. A second objective is to identify the efficient set for each region, and compare that efficient set to the broader efficient set that includes all metropolitan areas in the country. The weights that are associated with each MSA are constrained to be such that $0 \leq w_i \leq 1$ and $\Sigma_{i=1}^{N} w_i = 1$. The identification of the efficient sets (including the metropolitan areas and weights) involves the maximization of Equation (1)

Exhibit 2
Opportunity Sets of N Metropolitan Areas



with respect to Equation (2), with constraints on w_i as previously defined.[2]

The data for this study consists of quarterly retail occupancy rates for fifty-eight metropolitan statistical areas (MSAs) from 1987:1 to 2000:1, a period of time that encompasses a full cycle of expansion, recession and recovery. The retail occupancy rates reflect the interaction of demand and supply forces in fifty-eight metropolitan retail markets. The data set consists of 3,074 observations. The occupancy rate data, obtained from F.W. Dodge, cover the aggregate number of square feet of retail space in each market, excluding restaurants.

Results

The average occupancy rates from 1987:1 through 2000:1 across the fifty-eight MSAs are shown in Exhibit 3. In 1990:2, prior to the onset of the recession, the mean occupancy rate was 90.3%. The rate did not return to its pre-recession level until 1993:1, six quarters after the national economy came out of recession in 1991:2. In the early 1990s, the mean occupancy rate rose steadily through 1995:4; thereafter, the rate has remained above 92% through 2000:1.

In Exhibit 4, the occupancy rates are presented by MSA for 1987:1-2000:1. The average retail occupancy rate ranged from a high of 96.21% in San Francisco to a low of 83.03% in Fort Worth-Arlington. Several MSAs including Austin-San Marcos, Houston and Nashville have large variations in occupancy rates as indicated by the large standard deviations.

The risk/return occupancy profiles for the full sample of MSAs is presented in Exhibit 5. It is noteworthy that only twenty of the fifty-eight metropolitan areas are in the efficient opportunity set. These twenty metropolitan areas provide the highest occupancy rates for a given level of variation in the occupancy rates. Because thirty-eight MSAs had a zero-percent allocation, it would be necessary for an investor to hold retail space in only

Exhibit 3
Occupancy Rates by Quarter from 1987–2000

Year: Qtr	Mean	Std. Dev.	Minimum	Maximum
1987:1	91.865	4.052	79.154	98.528
1987:2	91.907	3.980	79.887	98.151
1987:3	91.818	4.173	79.178	98.051
1987:4	91.718	3.876	81.341	97.576
1988:1	91.224	4.577	76.767	98.053
1988:2	91.121	4.395	78.984	97.820
1988:3	91.024	4.308	79.947	97.479
1988:4	91.006	4.365	79.140	97.440
1989:1	90.849	4.377	79.291	97.600
1989:2	90.296	4.543	79.452	97.700
1989:3	90.318	4.803	75.294	97.900
1989:4	90.259	4.538	78.104	97.700
1990:1	90.717	3.945	81.719	97.100
1990:2	90.305	4.289	78.773	96.492
1990:3	89.916	4.500	76.569	96.087
1990:4	89.432	4.676	77.353	95.504
1991:1	89.494	4.244	78.573	95.200
1991:2	89.465	4.476	77.414	95.204
1991:3	89.654	4.589	76.501	95.435
1991:4	89.621	4.740	75.962	95.547
1992:1	89.291	4.517	76.143	95.700
1992:2	89.541	4.168	77.647	95.900
1992:3	89.680	3.925	80.206	95.968
1992:4	90.116	3.878	79.832	96.174
1993:1	90.531	3.901	80.225	96.641
1993:2	90.854	3.704	82.343	97.164
1993:3	91.039	3.763	82.589	96.938
1993:4	91.085	3.588	83.224	97.026
1994:1	91.101	3.484	83.744	96.820
1994:2	91.474	3.303	84.215	96.828
1994:3	91.607	3.022	85.335	97.068
1994:4	92.033	2.828	85.798	96.929
1995:1	92.161	2.632	86.771	96.928
1995:2	92.124	2.615	86.986	96.800
1995:3	92.175	2.479	87.486	96.829
1995:4	92.348	2.425	87.786	97.155
1996:1	92.341	2.414	87.430	97.227
1996:2	92.248	2.422	86.996	97.328
1996:3	92.234	2.441	86.425	97.440
1996:4	92.225	2.449	85.886	97.488
1997:1	92.287	2.446	85.580	97.566
1997:2	92.279	2.452	85.231	97.617
1997:3	92.292	2.525	84.953	97.690
1997:4	92.306	2.627	84.911	97.800
1998:1	92.264	2.667	84.903	97.895

Exhibit 3 (continued)
Occupancy Rates by Quarter from 1987–2000

Year: Qtr	Mean	Std. Dev.	Minimum	Maximum
1998:2	92.275	2.735	84.984	97.989
1998:3	92.297	2.762	85.074	98.034
1998:4	92.265	2.804	85.046	98.068
1999:1	92.220	2.893	84.849	98.057
1999:2	92.240	2.891	84.744	97.608
1999:3	92.189	2.863	84.692	97.600
1999:4	92.157	2.779	84.860	97.083
2000:1	92.091	2.748	85.140	97.200

Exhibit 4
Occupancy Rates by MSA from 1987–2000

MSA/State Name	Mean	Std. Dev.	Min.	Max.
Atlanta, GA	92.044	2.079	86.439	94.513
Austin-San Marcos, TX	87.719	4.069	81.705	94.368
Baltimore, MD	93.219	1.385	89.066	95.892
Birmingham, AL	93.652	1.083	92.123	95.599
Boston-Brockton, MA	96.091	1.719	91.059	98.068
Charlotte-Gastonia-Rock Hill, NC–SC	92.551	1.712	88.997	96.406
Chicago, IL	92.174	1.836	84.938	94.215
Cincinnati, OH–KY–IN	90.127	2.595	85.083	94.500
Cleveland-Lorain-Elyria, OH	92.518	1.025	90.929	94.391
Columbus, OH	92.084	1.280	90.501	94.678
Dallas, TX	85.898	2.732	80.320	90.133
Denver, CO	91.339	2.007	88.519	94.306
Detroit, MI	94.509	1.335	91.621	96.790
Fort Lauderdale, FL	89.463	1.969	84.706	93.032
Fort Worth-Arlington, TX	83.025	3.144	75.294	88.091
Greensboro–Winston-Salem–High Point, NC	91.626	1.694	89.333	96.174
Greenville-Spartanburg-Anderson, SC	89.120	1.986	85.092	92.400
Hartford, CT	95.202	1.707	90.643	97.900
Honolulu, HI	92.287	1.051	90.700	94.700
Houston, TX	83.162	4.654	75.779	88.838
Indianapolis, IN	93.673	2.016	91.371	97.118
Jacksonville, FL	86.142	3.630	79.619	91.715
Kansas City, MO-KS	92.336	2.162	88.650	95.574
Las Vegas, NV-AZ	93.280	1.918	89.936	95.774
Los Angeles-Long Beach, CA	94.741	1.470	90.399	97.389
Miami, FL	89.755	2.743	83.914	93.187
Milwaukee-Waukesha, WI	92.475	0.911	90.875	93.648
Minneapolis-St. Paul, MN-WI	92.002	1.305	89.055	94.319
Nashville, TN	86.982	4.169	78.307	91.958
Nassau-Suffolk, NY	91.652	1.187	89.800	93.800
New Haven-Bridgeport-Stamford, CT	94.844	1.501	91.228	98.528

Exhibit 4 (continued)
Occupancy Rates by MSA from 1987–2000

MSA/State Name	Mean	Std. Dev.	Min.	Max.
New Orleans, LA	89.273	1.937	85.829	92.185
New York City, NY	87.246	3.030	80.338	90.390
Newark, NJ	94.192	1.058	92.462	96.628
Norfolk-Virginia Beach-Newport News, VA-NC	89.812	2.519	85.787	94.965
Oakland, CA	89.951	2.184	84.967	93.410
Oklahoma City, OK	87.570	2.873	80.054	90.946
Orange County, CA	90.597	1.659	86.416	92.827
Orlando, FL	86.760	3.446	82.093	92.196
Philadelphia, PA–NJ	92.016	1.062	90.051	93.652
Phoenix-Mesa, AZ	89.416	1.283	86.347	91.745
Pittsburgh, PA	96.011	0.634	94.635	97.200
Portland-Vancouver, OR–WA	95.180	1.109	93.299	96.717
Raleigh-Durham-Chapel Hill, NC	93.794	2.495	88.156	97.600
Richmond-Petersburg, VA	92.428	2.123	88.560	97.338
Riverside-San Bernardino, CA	90.003	2.652	82.994	94.311
Sacramento, CA	90.071	1.794	84.719	92.900
Saint Louis, MO–IL	92.572	1.294	90.947	95.711
Salt Lake City–Ogden, UT	93.869	2.080	90.872	96.672
San Antonio, TX	86.592	2.098	81.698	90.535
San Diego, CA	94.201	0.997	92.055	95.996
San Francisco, CA	96.210	0.663	94.680	97.538
San Jose, CA	94.503	0.828	92.589	95.708
Seattle-Bellevue-Everett, WA	95.270	1.137	92.851	97.026
Tampa-St. Petersburg-Clearwater, FL	90.152	1.452	85.724	92.446
Tulsa, OK	90.780	2.425	84.700	94.000
Washington, DC-MD-VA-WV	92.043	0.991	90.132	93.570
West Palm Beach–Boca Raton, FL	87.529	1.142	86.186	91.268

approximately one-third of the MSAs in the sample. The MSAs with the largest allocations include Hartford, Nassau-Suffolk, Newark, Pittsburgh, Raleigh-Durham-Chapel Hill, San Francisco, San Jose and Tulsa. The efficient opportunity set points are labeled EF 1 through EF 10; the occupancy rates for these efficient portfolios range from 92.28% to 96.21%, while their respective portfolio standard deviations range from 0.06% to 0.63%.

The risk/return occupancy profiles for the Midwest, Northeast, South and West are shown in Exhibits 6–9. An examination of the efficient opportunity set points for these regions reveals the Midwest and South to be inferior to the Northeast and West as the occupancy rates are lower and the variation higher in these regions. Interestingly, the South and West have half or more of the MSAs excluded from the efficient set, while the Northeast and Midwest only have 30% to 40% of those excluded.

The efficient opportunity sets for the regions are presented in Exhibit 10. The graph clearly shows the advantage of having allocations in MSAs from around the country. For example, although the West and Northeast appear to be the best performing regions, the results for the full sample of MSAs offers about a 1% higher occupancy rate at lower risk levels. Looking at the results in terms of risk, a comparable occupancy rate portfolio at lower levels of risk offers about half the risk or less

Exhibit 5

Risk/Return Occupancy Profile for Portfolio of Full Sample of MSAs

Summary Portfolio Performance	EF 1	EF 2	EF 3	EF 4	EF 5	EF 6	EF 7	EF 8	EF 9	EF 10
Panel A: EF										
Occupancy (%)	92.276	92.713	93.15	93.587	94.024	94.461	94.898	95.336	95.773	96.21
Occupancy Std. Dev. (%)	0.064	0.068	0.076	0.09	0.108	0.131	0.171	0.229	0.322	0.663
Coefficient of Variation	0.00069	0.00073	0.00082	0.000962	0.00115	0.00139	0.00180	0.00240	0.00336	0.00689

Panel B: EF (%)

	EF 1 (%)	EF 2 (%)	EF 3 (%)	EF 4 (%)	EF 5 (%)	EF 6 (%)	EF 7 (%)	EF 8 (%)	EF 9 (%)	EF 10 (%)	Avg. (%)
MSA/State Name	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation
Chicago, IL	1	2	2	1	1	0	0	0	0	0	0.7
Cleveland-Lorain-Elyria, OH	5	2	1	0	0	0	0	0	0	0	0.8
Denver, CO	3	1	0	0	0	0	0	0	0	0	0.4
Greensboro—Winston-Salem–High Point, NC	0	0	0	1	1	1	3	3	0	0	0.9
Greenville-Spartanburg-Anderson, SC	6	4	3	2	0	0	0	0	0	0	1.5
Hartford, CT	0	0	0	3	6	8	13	20	17	0	6.7
Kansas City, MO–KS	1	2	3	2	2	0	0	0	0	0	1.0
Nassau-Suffolk, NY	11	12	11	7	3	0	0	0	0	0	4.4
New Haven-Bridgeport–Stamford, CT	0	2	3	4	5	5	2	0	0	0	2.1
Newark, NJ	6	11	15	17	20	19	11	0	0	0	9.9
Phoenix-Mesa, AZ	4	2	0	0	0	0	0	0	0	0	0.6
Pittsburgh, PA	7	7	8	10	13	17	24	30	40	0	15.6
Portland-Vancouver, OR–WA	0	2	4	2	0	0	0	0	0	0	0.8
Raleigh-Durham-Chapel Hill, NC	5	6	7	8	9	10	10	12	8	0	7.5
Saint Louis, MO–IL	8	6	5	5	5	3	0	0	0	0	3.2
San Diego, CA	8	8	7	6	4	2	3	2	0	0	4.0
San Francisco, CA	0	0	3	5	7	12	22	30	35	100	21.4
San Jose, CA	13	14	14	13	13	11	6	0	0	0	8.4
Tulsa, OK	13	12	11	11	11	9	6	2	0	0	7.5
West Palm Beach–Boca Raton, FL	8	6	5	3	1	0	0	0	0	0	2.3
Total	99	99	102	100	101	97	100	99	100	100	99.7

Note: The MSAs not shown in the exhibit had a zero percent allocation including Atlanta, Austin-San Marcos, Baltimore, Birmingham, Boston-Brockton, Charlotte-Gastonia-Rock Hill, Cincinnati, Columbus, Dallas, Detroit, Fort Lauderdale, Fort Worth-Arlington, Honolulu, Houston, Indianapolis, Jacksonville, Las Vegas, Los Angeles-Long Beach, Miami, Milwaukee-Waukesha, Minneapolis-St. Paul, Nashville, New Orleans, New York City, Norfolk-Virginia Beach-Newport News, Oakland, Oklahoma City, Orange County, Orlando, Philadelphia, Richmond-Petersburg, Riverside-San Bernardino, Sacramento, Salt Lake City-Ogden, San Antonio, Seattle-Bellevue-Everett, Tampa-St. Petersburg-Clearwater and Washington D.C.

Exhibit 6
Risk/Return Occupancy Profile for Midwest Region

Summary Portfolio Performance	EF 1	EF 2	EF 3	EF 4	EF 5	EF 6	EF 7	EF 8	EF 9	EF 10
Panel A: EF										
Occupancy (%)	92.599	92.811	93.023	93.236	93.448	93.660	93.872	94.084	94.297	94.509
Occupancy Std. Dev. (%)	0.498	0.505	0.534	0.590	0.664	0.752	0.862	0.991	1.130	1.335
Coefficient of Variation	0.005	0.005	0.006	0.006	0.007	0.008	0.009	0.011	0.012	0.014

Panel B: EF (%)

	EF 1 (%)	EF 2 (%)	EF 3 (%)	EF 4 (%)	EF 5 (%)	EF 6 (%)	EF 7 (%)	EF 8 (%)	EF 9 (%)	EF 10 (%)	Avg. (%)
MSA/State Name	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation
Chicago, IL	1	0	0	0	0	0	0	0	0	0	0
Cleveland-Lorain–Elyria, OH	41	45	44	43	43	42	31	18	4	0	31
Detroit, MI	6	16	26	37	47	57	67	74	81	100	51
Indianapolis, IN	0	0	0	0	0	0	2	9	15	0	3
Milwaukee–Waukesha, WI	45	40	30	20	11	1	0	0	0	0	15
Minneapolis-St. Paul, MN–WI	2	0	0	0	0	0	0	0	0	0	0
Saint Louis, MO–IL	5	0	0	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100	100	100	100

Note: The MSAs not shown in the exhibit had a zero percent allocation including Cincinnati, Columbus and Kansas City.

Exhibit 7

Risk/Return Occupancy Profile for Northeast Region

Summary Portfolio Performance	EF 1	EF 2	EF 3	EF 4	EF 5	EF 6	EF 7	EF 8	EF 9	EF 10
Panel A: EF										
Occupancy (%)	94.679	94.836	94.992	95.149	95.306	95.463	95.620	95.777	95.934	96.091
Occupancy Std. Dev. (%)	0.370	0.370	0.372	0.375	0.380	0.389	0.399	0.412	0.499	1.719
Coefficient of Variation	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.018
Panel B: RF (5)										
	EF 1 (%)	EF 2 (%)	EF 3 (%)	EF 4 (%)	EF 5 (%)	EF 6 (%)	EF 7 (%)	EF 8 (%)	EF 9 (%)	EF 10 (%)	Avg. (%)
MSA/State Name	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation
Boston-Brockton, MA	0	0	0	0	0	0	0	0	0	100	10
Hartford, CT	6	8	9	11	13	16	18	21	10	0	11
Nassau-Suffolk, NY	24	22	20	18	14	10	6	2	0	0	12
Philadelphia, PA-NJ	6	4	2	0	0	0	0	0	0	0	1
Pittsburgh, PA	64	67	69	72	73	75	76	78	90	0	66
Total	100	100	100	100	100	100	100	100	100	100	100

Note: The MSAs not shown in the exhibit had a zero percent allocation including New Haven–Bridgeport–Stamford, New York City and Newark.

Exhibit 8
Risk/Return Profile for South Region

Summary Portfolio Performance	EF 1	EF 2	EF 3	EF 4	EF 5	EF 6	EF 7	EF 8	EF 9	EF 10
Panel A: EF										
Occupancy (%)	91.830	92.048	92.266	92.485	92.703	92.921	93.139	93.357	93.576	93.794
Occupancy Std. Dev. (%)	0.274	0.276	0.282	0.297	0.319	0.353	0.397	0.448	0.522	2.495
Coefficient of Variation	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.005	0.006	0.027

Panel B: EF (%)

	EF 1 (%)	EF 2 (%)	EF 3 (%)	EF 4 (%)	EF 5 (%)	EF 6 (%)	EF 7 (%)	EF 8 (%)	EF 9 (%)	EF 10 (%)	Avg. (%)
MSA/State Name	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation
Baltimore, MD	3	4	7	10	12	13	15	17	19	0	10
Birmingham, AL	20	20	24	27	31	35	40	44	57	0	30
Charlotte-Gastonia-Rock Hill, NC–SC	9	7	7	6	5	4	2	1	0	0	4
Greensboro-Winston Salem-High Point, NC	12	13	11	9	8	8	7	6	0	0	7
New Orleans, LA	0	0	0	0	0	0	0	0	0	0	0
Norfolk-Virginia Beach-Newport News, VA–NC	12	12	11	11	9	6	4	1	0	0	7
Oklahoma City, OK	0	0	0	0	0	0	0	0	0	0	0
Orlando, FL	1	0	0	0	0	0	0	0	0	0	0
Raleigh-Durham-Chapel Hill, NC	5	7	11	16	19	21	23	24	22	100	25
Richmond-Petersburg, VA	0	1	3	5	6	6	7	8	2	0	4
Tampa-St. Petersburg–Clearwater, FL	3	0	0	0	0	0	0	0	0	0	0
Tulsa, OK	20	17	15	13	10	7	3	0	0	0	8
Washington, DC–MD–VA–WV	14	19	11	3	0	0	0	0	0	0	5
Total	100	100	100	100	100	100	100	100	100	100	100

Note: The MSAs not shown in the exhibit had a zero percent allocation including Atlanta, Austin-San Marcos, Dallas, Fort Lauderdale, Fort Worth-Arlington, Greenville-Spartanburg-Anderson, Houston, Miami, Nashville, New Orleans, Oklahoma City, San Antonio and West Palm Beach-Boca Raton.

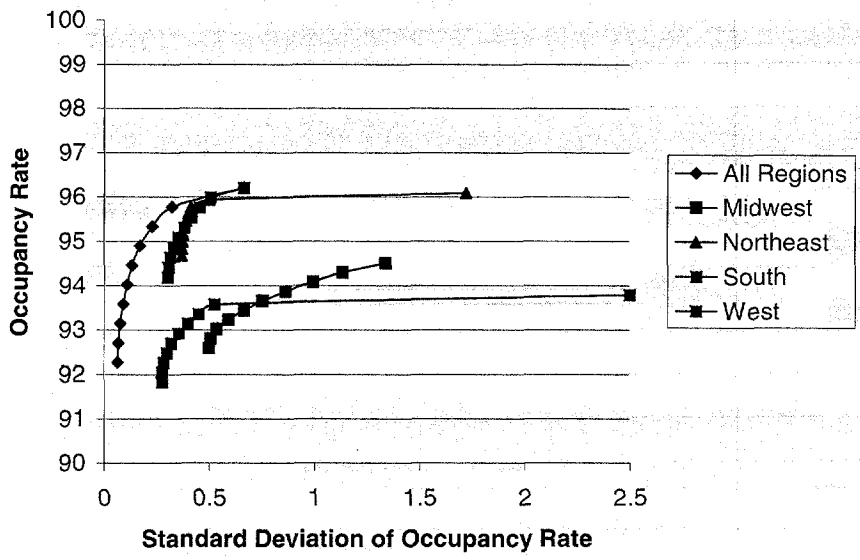
Exhibit 9

Risk/Return Occupancy Profile for West Region

Summary Portfolio Performance	EF 1	EF 2	EF 3	EF 4	EF 5	EF 6	EF 7	EF 8	EF 9	EF 10	
Panel A: EF											
Occupancy (%)	94.189	94.414	94.638	94.863	95.087	95.312	95.536	95.761	95.985	96.210	
Occupancy Std. Dev. (%)	0.300	0.304	0.314	0.330	0.353	0.381	0.414	0.452	0.505	0.663	
Coefficient of Variation	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.005	0.005	0.007	
Panel B: EF(%)											
	EF 1 (%)	EF 2 (%)	EF 3 (%)	EF 4 (%)	EF 5 (%)	EF 6 (%)	EF 7 (%)	EF 8 (%)	EF 9 (%)	EF 10 (%)	Avg. (%)
MSA/State Name	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation	Allocation
Honolulu, HI	23	20	18	14	10	6	2	0	0	0	9
Orange County, CA	3	2	0	0	0	0	0	0	0	0	1
Portland-Vancouver, OR–WA	0	1	5	6	8	10	11	11	6	0	6
San Diego, CA	0	0	3	5	6	8	10	8	0	0	4
San Francisco, CA	9	14	19	28	36	44	52	63	77	100	44
San Jose, CA	41	38	33	26	19	13	6	0	0	0	18
Seattle-Bellevue-Everett, WA	24	25	23	22	21	20	19	17	18	0	19
Total	100	100	100	100	100	100	100	100	100	100	100

Note: The MSAs not shown in the exhibit had a zero percent allocation including Denver, Las Vegas, Los Angeles-Long Beach, Oakland, Phoenix-Mesa, Riverside-San Bernardino, Sacramento and Salt Lake City–Ogden.

Exhibit 10
Occupancy Efficient Frontiers



compared with the West or Northeast. The Midwest and South efficient frontiers are clearly dominated by the other regional efficient frontiers, and the Midwest, in particular, has much more risk at multiple levels of allocation.[3]

Conclusion

This study examines the integration of retail space markets using portfolio theory. The efficient opportunity sets and associated percentage allocations are determined for the entire sample of fifty-eight MSAs as well as for subsets for each region of the country. The data span fifty-three quarters starting the first quarter of 1987.

The findings indicate that retail space markets are not well integrated: some regions offer much higher performance in a risk/return occupancy context than others. Also, the occupancy risk/return performance improves substantially when allocations are not limited to particular regions. However, it is not necessary to invest in all fifty-eight MSAs to achieve a high degree of diversification benefit. In fact, only twenty of the fifty-eight regions are actually part of the efficient opportunity set, and, of those, only about half achieved significant allocations. Those metropolitan areas that enter into the efficient opportunity set at the national level are not necessarily "New Economy" MSAs. Rather, they are a mix of both "Old Economy" and "New Economy" types that have beneficial covariation in occupancy rate movements.

The findings are important to lenders, planners, developers, REIT portfolio managers and others who make real estate investment and portfolio decisions in the retail sector. The major findings of the research are:

- Retail space markets are not well integrated, suggesting that market diversification can produce significant reductions in risk for the same level of occupancy.
- A system of diversifying nationally among major metropolitan markets is superior to diversifying within major geographic regions, such as, the West or South.
- The most effective diversification strategy is achieved by investing in just 20 of the 58 metropolitan markets examined.

While this research remains to be confirmed with further work focused on other property types and using better measures of returns, it points to significant gains from market diversification.

Notes

1. See, for example, Flavin and Yamashita (1998), Rowland and Tesar (1998), Baz, Breedon, Naik and Peress (2001) and Chamorro and Perez de Villarreal (2000).
2. The efficient sets were identified using Matlab 5 with the Statistics, Finance and Optimization Toolboxes.
3. The efficient frontiers for the Northeast and South are extended to high-risk levels only for the highest risk portfolio.

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